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**USDA-UC PD Grant Progress Report**

I. "**Grapevine xylem phenolic composition: Correlation with susceptibility to Pierce's Disease and induction trials"**

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III. List of objectives and description of activities conducted to accomplish each objective

The objectives of the 2 year project are listed below:

1. Identify phenolic composition of xylem fluid in different species (from tolerant native vines to susceptible Vitis vinifera) to see if there is a correlation between composition and disease resistance over four seasons.
2. Identify phenolic composition of xylem fluid in different Vitis vinifera species (most susceptible to least susceptible) to see if there is a correlation between composition and disease resistance.
3. Compare phenolic composition of xylem fluid with *Xylella fastidiosa* populations.
4. In preliminary experiments, induce t-resveratrol in grapevine tissue and measure xylem sap concentration before and after treatment.

The accomplishments of the objectives are listed below:

1,2. Varietals (except for the two native resistant grapevines) used in this study as well as locales are listed in Table 1. A map of the respective sites is shown in Figure 1.

| "Cold" Location | | | | |
|---|---|---|---|---|
| **Vineyard** | **Elevation (ft)** | **County** | **Location (lat/long)** | **Varietal** |
| Boeger 1 | 2400 | El Dorado | 38 44.516 -120 41.907 | Cabernet sauvignon |
| Boeger 2 | 2623 | El Dorado | 38 45.373 -120 42.638 | Pinot noir |
| Moore | 2928 | El Dorado | | Zinfandel |
| Lahey | 2406 | El Dorado | 38 44.837 -120 46.166 | Petit sirah |
| Lava Cap | 2622 | El Dorado | 38 45.231 -120 44.677 | Chardonnay |
| Bush 1 | 2843 | El Dorado | 38 41.169 -120 41.916 | Barbera |
| Bush 2 | 2826 | El Dorado | 38 41.101 -120 41.872 | Zinfandel |
| Girard | 1400 | El Dorado | 38 46.480 -120 53.230 | Merlot |

| "Warm" Location | | | | |
|---|---|---|---|---|
| **Vineyard** | **Elevation (ft)** | **County** | **Location (lat/long)** | **Varietal** |
| Martinez 1 | 150 | Yolo | 38 30.466 -121 59.462 | Pinot noir |
| Martinez 2 | 150 | Yolo | 38 30.466 -121 59.462 | Zinfandel |
| Martinez 3 | 150 | Yolo | 38 30.466 -121 59.462 | Petit sirah |
| Martinez 4 | 150 | Yolo | 38 30.466 -121 59.462 | Chardonnay |
| Martinez 5 | 150 | Yolo | 38 30.466 -121 59.462 | Barbera |
| Martinez 6 | 150 | Yolo | 38 30.466 -121 59.462 | Zinfandel |
| Martinez 7 | 150 | Yolo | 38 30.466 -121 59.462 | Merlot |
| | | | | |
| Oakville 1 | 185 | Napa | 38 25.422 -122 24.276 | Cabernet sauvignon |
| Oakville 2 | 185 | Napa | 38 25.422 -122 24.276 | Zinfandel 1 |
| Oakville 2 | 185 | Napa | 38 25.422 -122 24.276 | Zinfandel 2 |

Table 1. Vineyard information

Figure 1. Regional map

We would like to acknowledge the cooperation and support from Lynn Wunderlich, UC Extension Farm Advisor for El Dorado County. She assisted us in locating vines to match the project requirements. This involved finding vines at seven different companies, and many different locations. All vineyards were at 1500 to 2900 ft elevation in order to attain adequate chilling in the winter. All received snowfall during the winter of 2010-2011.

To date, *Vitis vinifera* canes have been sampled at two discrete time points, November 2010 and February 2011. Two resistant native vines, *Muscadinia rotundifolia* "Trayshed" and *Vitis arizonica* "643.17" supplied by Dr. Andy Walker were sampled once in November. Xylem fluid was extracted using a pressure bomb and is being stored at -80ºC awaiting analysis. All xylem samples will be analyzed in the same time period (after the fourth collection) to reduce analytical error.

CIMIS (California Irrigation Management Information System) stations closest to the vineyard sites have been identified and are being monitored for monthly average maximum and minimum air temperatures as well as daily minimum temperatures during the cold season. Duration at low temperature can be ascertained from the hourly data. Stations include: #13 – Sierra Foothill (Camino), Station #6 Sacramento Valley (Davis) and Station #77 - North Coast Valleys Region Napa County (Oakville).

3. A protocol for quantifying *Xylella fastidiosa* populations has been selected with the help of Dr. David Gilchrist, Professor of Plant Pathology, UC Davis. DNA isolation using grape tissue for Real-Time PCR with *Xf* quantification will be employed. This procedure is currently being used with great success in the Gilchrist lab. DNA is isolated in several steps and quantified via spectrophotometer. First, grape tissue is ground in liquid nitrogen to lyse cells and various reagents and enzymes "clean" the homogenate. DNA is then extracted by solvent addition and precipitated out from the aqueous solution. Salts are removed and DNA is resuspended in a buffer. Calculations are based on optical density readings which relate to dsDNA concentration. Tissue samples will be taken in the late summer of 2011 when PD symptoms are most noticeable.

4. Induction trials will take place in the summer of the second year (2012).

IV. Summary of major research accomplishments and results for each objective.

To date, seven *Vitis vinifera* species have been identified in both climate regions ("warm" and "cold") as well as two resistant native grapevine species in the UC Davis research facility. Collaboration and cooperation with various owners, vineyard managers and Lynn Wunderlich, UC Extension Farm Advisor for El Dorado County is in place. Two sampling cycles have been completed.

V. Publications or reports- not applicable at this time

VI. Presentation of Research – not applicable at this time

VII. Research relevance statement (how this research contributes towards solving the PD/GWSS problem in California)

We are investigating a possible biological mechanism of resistance to Pierce's Disease. This new project expands on the recent findings that showed resveratrol and several related compounds in the xylem fluid of "cold" climate grapevines inhibit *Xf* in vitro. Thus, these compounds could have an inhibitory affect on *Xf* in the vine. The survey of xylem phenolic composition in different grape varieties will allow a comparison to be made in regards to the varietal's susceptibility rating to Pierce's Disease. If, in fact, resveratrol or other xylem components are bioactive, this mechanism of resistance may be inducible with existing vines.

VIII. Lay summary

We have started this project by identifying similar grapevines in warm and cold climate regions. These are matched by scion, and where possible by scion and rootstock. In addition, we have collected xylem fluid samples at two of the planned four time points for analysis. Methodology for chemical analysis is already established and testing for bacteria is being conducted in cooperation with a plant pathology expert.

IX. Status of funds- To date, $11,803.17 has been expended and an encumbrance of $10,526.32 for personnel for the balance of the year has been deducted from the first year funds of $43,775. A balance of $21,445.49 remains.

X. Summary/status of IP – As stated in the research proposal, the first year of the project (survey of xylem phenolic composition) is not expected to yield intellectual property.